

Neuro-fuzzy modeling of a conveyor-belt grain dryer.

ABSTRACT

The grain drying process is one of the most critical post-harvest operations in modern agricultural production. Development of a reliable control strategy for this process plays an important role in improving the overall efficiency and productivity of the drying process. In control system design, the first problem to be addressed is the availability of a relatively simple and accurate model of the process to be controlled. However, the majority of the models developed for the grain drying process and the numerical methods required to solve them are characterized by their highly complex nature, and thus they are not suitable to be utilized in control system design. This paper presents an application of a neuro-fuzzy system, in particular the adaptive neuro-fuzzy inference system (ANFIS), to develop a data-driven model for a conveyor-belt grain dryer. This model can be easily used in control system design to develop a reliable control strategy for the drying process. By conducting a real-time experiment to dry paddy grains, a set of input-output data were collected from a laboratory-scale conveyor-belt grain dryer. These data were then presented to the ANFIS network in order to learn the nonlinear functional relationship between the input and output data by this network. Based on utilizing a clustering method to identify the structure of the ANFIS network, the resulting ANFIS model has shown a remarkable modeling performance to represent the drying process. In addition, the modeling result achieved by this ANFIS model was compared with those of an autoregressive with exogenous input (ARX) model and an artificial neural network (ANN) model, and the results clearly showed the superiority of the ANFIS model.

Keyword: Grain drying; Conveyor-belt grain dryers; Neuro-fuzzy systems; ANFIS network; Fuzzy c-means clustering; Autoregressive with exogenous input model; Artificial neural network.